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Model of the aral sea sedimentary cycles

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Abstract

© SGEM2018. The goal of this project was to create a detailed model of the Aral Sea sedimentary cycles. Modern methods of image processing and wavelet analysis were used to reveal the nature of lamination and determine the average and interval sedimentation rates. The results obtained were then compared with those from the radiocarbon dating. The images used in this project are photographs of core (sediment) samples taken with hollow plastic tubes. The samples were removed from the tubes by cutting them in half lengthwise, and then photographed. The image resolution was 0.34 mm. The task of identifying the periodic components and determining the quantitative characteristics of individual cycles and microcycles was accomplished through the wavelet analysis of the “brightness” curve. The cycles that make up the sedimentation model have periods of 1, ≈2, ≈5, ≈13, ≈50 and ≈200 years (i.e. they are well aligned with the common climatic cycles). The average sedimentation rate is estimated at 2-3 mm/year. The model shows that a 50 cm thick sediment forms in ~160 years. The radiocarbon dating, however, produced a different outcome – 440 ± 100 years. Obviously, the differences in the results are not trivial even if the likely level of error is taken into account.

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Keywords

Annual laminations, Depositional cycle, Image processing, Thin-laminated clays, Wavelet

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